

Sistemet e Bazës së të Dhënave

Konceptet e Sistemit të Bazës së të Dhënave

Ramiz HOXHA

ramiz.hoxha@ubt-uni.net

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FAKULTETI: SHKENCAVE KOMPJUTERIKE DHE INXHINIERIS

Mësimdhensit

□ Profesori: Ramiz Hoxha

- Email: ramiz.hoxha@ubt-uni.net
- Orari: Konsultimeve do te definohet

□ Asistentet:

- Medina Shamolli (medina.shamolli@ubt-uni.net)
- Arbër Kadriu (arber.kadriu@ubt-uni.net)
- Orari: Konsultimeve do te definohet

syllabusi – planifikim i ligjeratave dhe ushtrime

| Java | Njesia mesimore |
|-----------------------------|---|
| 1. | Konceptet e Bazes se te Dhenave |
| 2. | Basic SQL (DML, SELECT, Where etj.) |
| 3. | Produkti kartezian |
| 4. | ERD (Modelimi i te Dhenave) |
| 5. | ERD (Entitete, Atribute, Relacione, Specializim ... etj.) |
| Fillimi i punës me projekt | |
| 6. | ERD to Relational Model |
| 7. | Normalizimi (eventualisht shtyhet për javën e 12) |
| 8. | Algjebër Relacionare |
| Dorëzimi i parë i projektit | |
| 9. | DDL |
| 10. | Joins |
| Dorëzimi i dytë | |
| 11. | Subquery / with / view |
| 12. | Procedurat |

Planifikimi për Lëndën: *syllabusi – vlersimi*

□ Aktiviteti i Vlerësimit

- Projekti= 30 pike
- Testi Final = 70 pike (Gjate nje viti akademik= 3 afate te rregullt te provimit)
- Detyra extra 10 pike

□ Pjesëmarrja - studenti duhet të marrë pjesë në ligjerata min. **75%** dhe ushtrimet laboratorike për t'u kualifikuar për të i nenshtruar testit final / provime

- Nuk e pëlqej pjesëmarrjen e detyrueshme ... por kemi vërejtur ...
- Studentet që nuk morën pjesë ishin më keq
- Studentet që nuk morën pjesë ishin më pak të kënaqur me kursin



□ Studentet **perserits** nuk jane te obliguar te pjesmarr te ligjeratave por jane te obliguar te l perfundojn te gjitha aktivitet (pjeset e projektit dhe detyrave) te parapar.

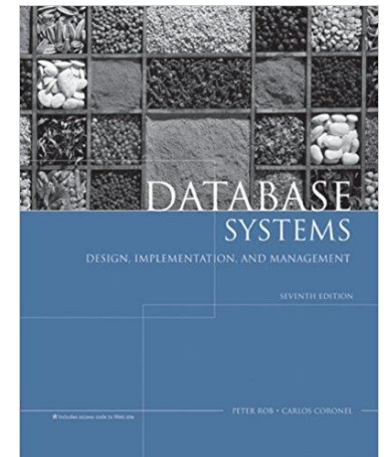
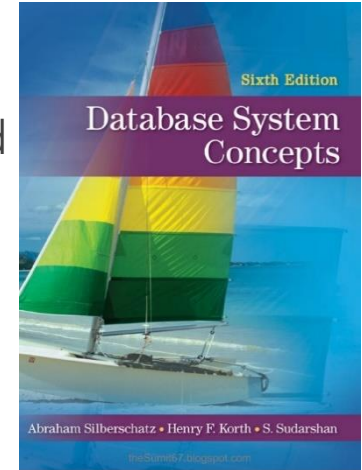
- Kualefikohen per (nota maximale 8-tete:
 - 50-65 pike nota 6 Gjashte
 - 66-85 pike nota 7 Shtate
 - 86-100 pike nota 8 Tete

Referencat për Lënden

□ Librat për Lëndën:

- **Database System Concepts** (Sixth Edition), Abraham Silberschatz, Henry Korth and S. Sudarshan, McGraw-Hill, 2010.
- **Database Systems: Design, Implementation, and Management**, Eighth Edition by Peter Rob and Carlos Coronel

□ Moodle (ligjeratat-PowerPoint, materiale-Ushtrime.. etj)










Topics and Intended Learning Outcomes



PJESA PARË

Database Developer Salaries

3,974 Salaries Updated Oct 18, 2020

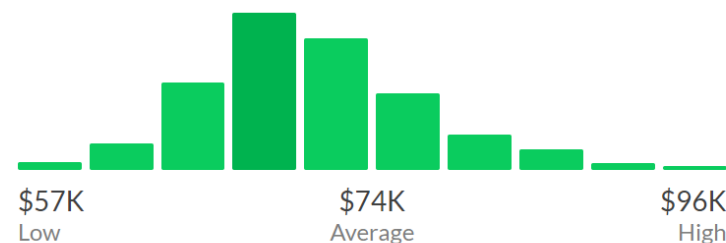
 **Very High**
Confidence

 Industries   Select your opti...   Select your opti... 

 To filter salaries for Database Developer, [Sign In](#) or [Register](#). 

Average Base Pay

\$73,506 / yr



Additional Cash Compensation 

| | |
|---------|----------|
| Average | \$xx,xxx |
| Range | \$xx,xxx |

How much does a Database Developer make?
The national average salary for a Database Developer is \$73,506 in United States. Filter by location to see... [More](#)

Salaries for Related Job Titles

| | |
|---------------------------|--------|
| Database Engineer | \$142K |
| SQL | \$82K |
| SQL Database Developer | \$82K |
| Database Analyst | \$62K |
| Senior Database Developer | \$86K |

Database Developer Jobs

839 [search results](#)

 Latest Job Offers

SQL Database Developer

£60000 - £70000 per annum

City of London, London, South East, UK

Senior Clinical Trials Database Developer

£38,084 - £44,807 per annum

England

Database Developer - (Office or Remote - Work from Home)

GBP 44000-49000 yearly

London, England

Database Developer - Public Sector - Outside IR35

£300 - £450 per Day + Outside IR35

London, GBR

Ref: https://www.glassdoor.com/Salaries/database-developer-salary-SRCH_KO0,18.htm

Germany / Job / SQL Developer

Average SQL Developer Salary in Germany

€45,000

Avg. Salary

Help us gather more data!

Find out what you're worth.

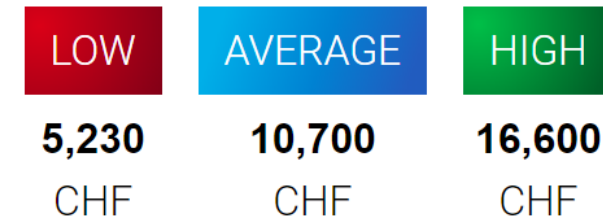
The average salary for a SQL Developer in Germany is €45,000.



Average Monthly Salary

10,700 CHF

(128,000 CHF yearly)



A person working as a **Database Developer** in **Switzerland** typically earns around **10,700 CHF** per month. Salaries range from **5,230 CHF** (lowest) to **16,600 CHF** (highest).

Ref: https://www.payscale.com/research/DE/Job=SQL_Developer/Salary

Ref: <http://www.salaryexplorer.com/salary-survey.php?loc=210&loctype=1&job=815&jobtype=3>

❑ Database Developer job description

- ❑ Database Developers are responsible for data gathering before development of a database. They design, develop, test, implement and maintain new and existing databases. Database developers create management methods and systems to access efficiently to information stored in databases. They work with consultants and other members of the company to improve processes.

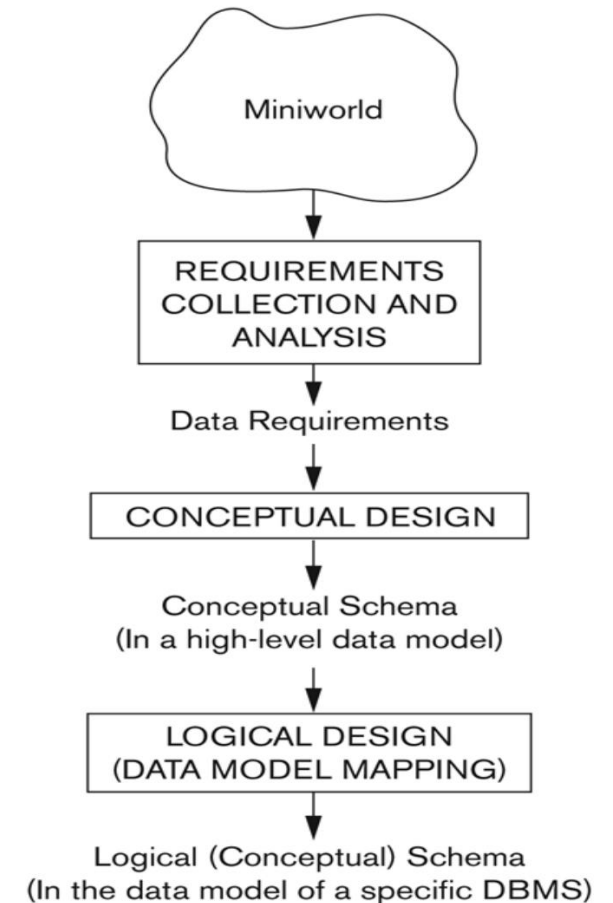
❑ A Database Developer does the following tasks:

- Modifying databases and products according to client needs.
- Working to create functional requirements.
- Providing assistance to others in topics related to data management.
- Creating reports on databases.
- Designing and developing database architectures.

Ref: <https://www.jobisjob.co.uk/database-developer/job-description>

After the course you should be able to ...

- ❑ Design relational databases for different types of example domains by first creating a conceptual schema using the Enhanced Entity-Relationship (EER) model and then translating this conceptual schema into a corresponding logical schema captured in the relational data model.
- ❑ Analyze and improve the quality of given relational database schemas based on the formal measure of normal forms.



After the course you should be able to ...

- ❑ Employ the SQL language to query and to modify several example relational databases, as well as to create such a database with a given relational database schema.
- ❑ Compare the cost of finding and updating records in database storage files when using different approaches to organize and to index such files.
- ❑ Apply basic techniques that DBMSs may use to identify and to avoid problems that may occur when multiple users access a database concurrently.
- ❑ Apply recovery algorithms that DBMSs use to guarantee persistence of data even in the case of system failures.

Course Outline

□ From a user perspective

- Basic concepts: database, DBMS, ...
- Data modeling: ER, relational, OO, ...
- Database design: logical & physical design
- Use of databases: query, update, loading, ...
- Database applications: design, implementing

□ From a system perspective

- Data storage: device, structure, access, ...
- Query processing, optimization
- Transaction processing, and more ...

Course Topics

☐ Data Modeling

- Entity-Relationship Model
- ODL (Object-oriented Design Language)

☐ Relational Model

- Relational Algebra
- ODL/ER to Relation transformation

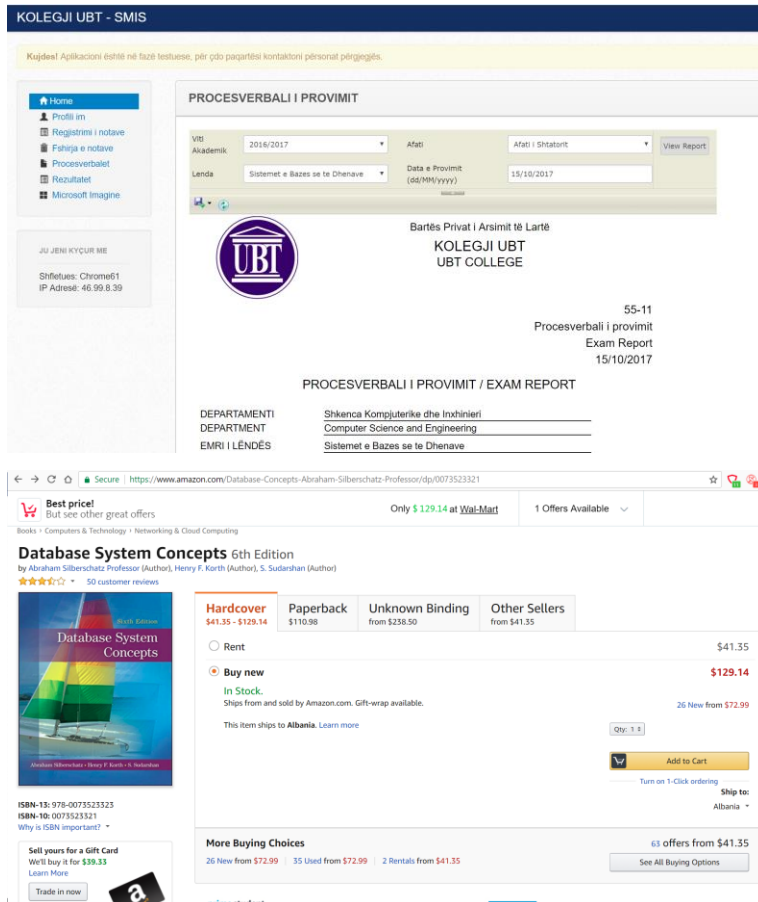
☐ Functional dependencies and normalization

☐ SQL (Standard Query Language)

- Query, View, Constraints
- Embedded SQL, PL/SQL (Stored procedures)

shembuj të sistemeve të bazave të të dhënave

Shembull: sistemeve të bazave të të dhënave



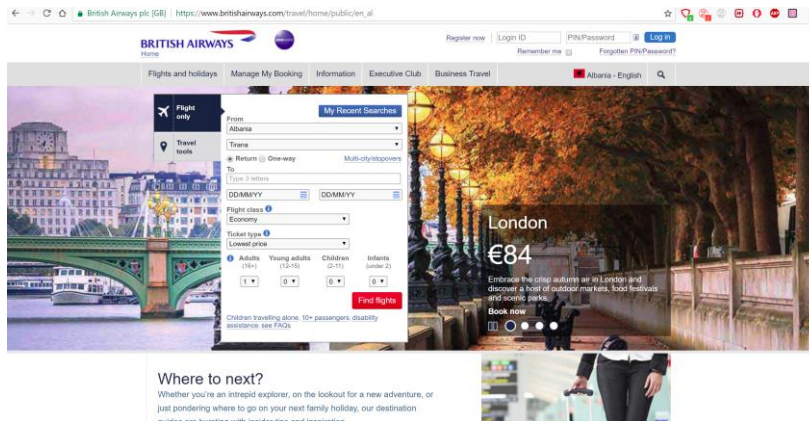
□ SMIS

- regjistrimi i notave, raporti i proceverbaleve, paraqitja e provimeve, raporti i transkriptes se notave, ...etj.,

□ Dyqanet online

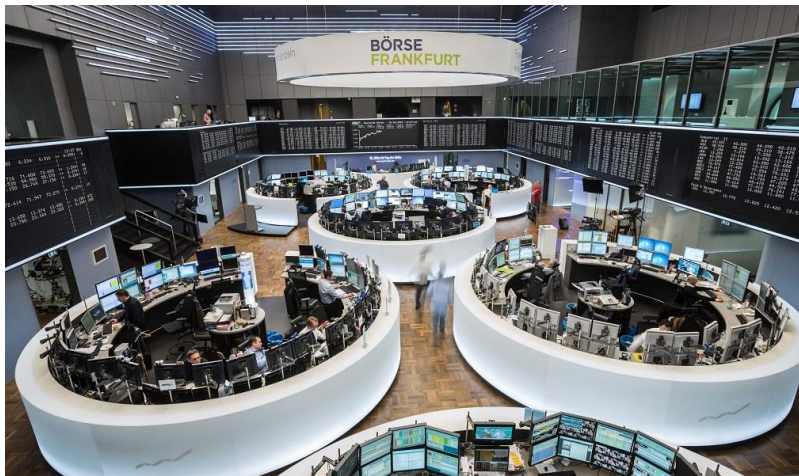
- informacionet e produktit, të dhënat konsumatorit, të dhënat e porositjes, ...
- p.sh: Amazon.com
 - qindra miliona konsumatorë
 - më shumë se 50 terabajt e të dhënash

Shembull: sistemeve të bazave të të dhënave...



□ Sistemet e rezervimit

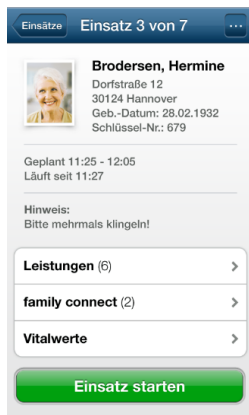
- Rezervimi i fluturimeve nga linja ajrore të shumta, dhoma hoteli etj.
 - British Airways



□ Bursat tregtare

- të dhënat e klientit, informacioni i llogarisë, transaksionet,
- p.sh: Bursa e Londrës
 - gati 1 milion tregtime në ditë

Shembull: sistemeve të bazave të të dhënave...



❑ **Bazat e të dhënave të ngulitur (embedded)** në makina, aeroplanë etj

- p.sh: menaxhimin e konfigurimeve dhe ruajtjen e të dhënave të sensorëve

❑ **Shumë pajisje të përditshme përmbajnë bazat e të dhënave.**

- TV, makina larëse, telefona celularë, ...
 - p.sh. Telefonat Android me bazën e të dhënave SQLite



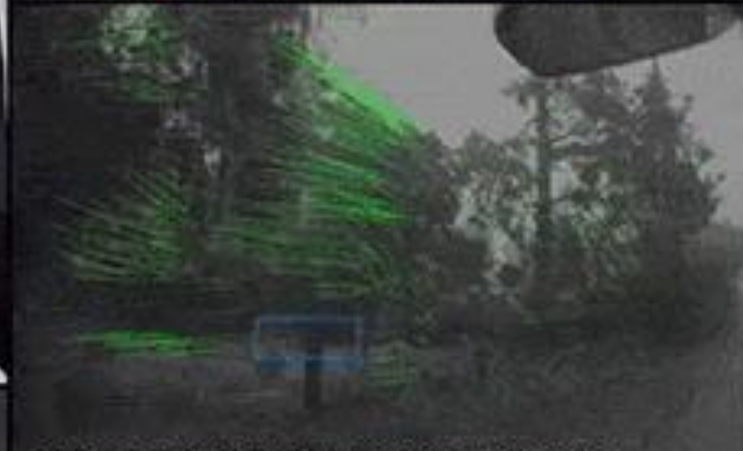
Example
Self Driving Cars



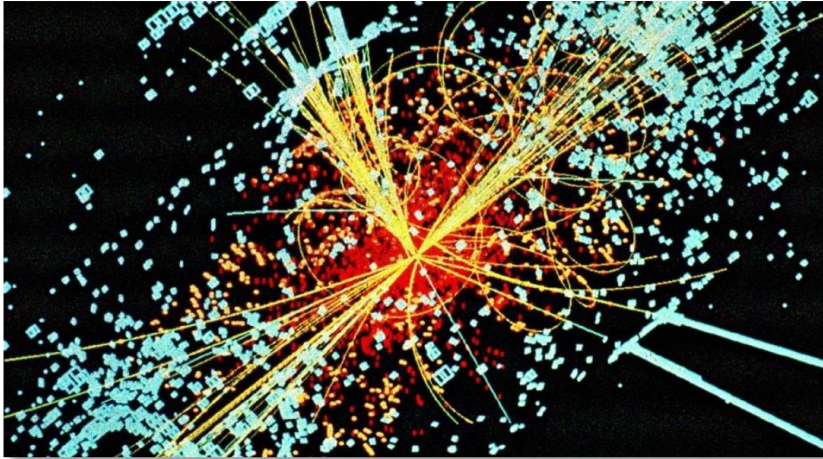
LEFT REARWARD VEHICLE CAMERA



MEDIUM RANGE VEHICLE CAMERA

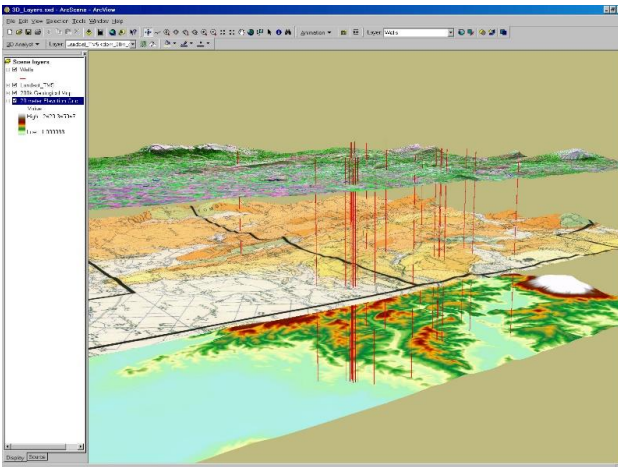


Shembull: sistemeve të bazave të të dhënave...



□ Bazat e të dhënave e sistemeve shkencore

- të dhënat e sensorëve, klasifikimet (p.sh. gjenomi i njeriut), si dhe të dhënat nga simulimet.
 - p.sh: Large Hadron Collider (LHC)
 - 15 petabytes të të dhënave në vit



□ Sistemet e Informacionit Gjeografik (GIS)

- (GIS) është një sistem kompjuterik për kapjen, ruajtjen, kontrollimin dhe shfaqjen e të dhënave lidhur me pozicionet në sipërfaqen e Tokës,
- gjuha e pyetsorve gjeohapësinor

Bazat e të Dhënave në Veprim...

Bazat e të dhënave prekin të gjitha aspektet e jetës sonë të përditshme!

- ❑ Shumë kompani të mëdha të bazës së të dhënave
 - p.sh. **Oracle** është kompania e *dytë* më e madhe në 2017
- ❑ Bazat e të dhënave përbëjnë një pjesë të rëndësishme të linjave të prodhimit
 - **Microsoft (SQL Server), IBM (DB2), ...**

Konceptet e Sistemit të Bazës së të Dhënave

PJESA TRETË

The Study of Databases

□ Several aspects:

- Database programming: querying and update operations
- Database implementation
- Modeling and design of databases

□ Database study cuts across many fields of Computer Science: OS, languages, AI, Logic, multimedia, theory, ...

What is a Database System?

Database System = Database + DBMS

□ A Database is

- A large, integrated collection of data
- Models a real-world enterprise.
 - Entities (e.g., students, courses)
 - Relationships (e.g., Agim ndegjon DB)

□ A Database Management System (DBMS) is a software package designed to store and manage databases easily and efficiently.

Types of Database

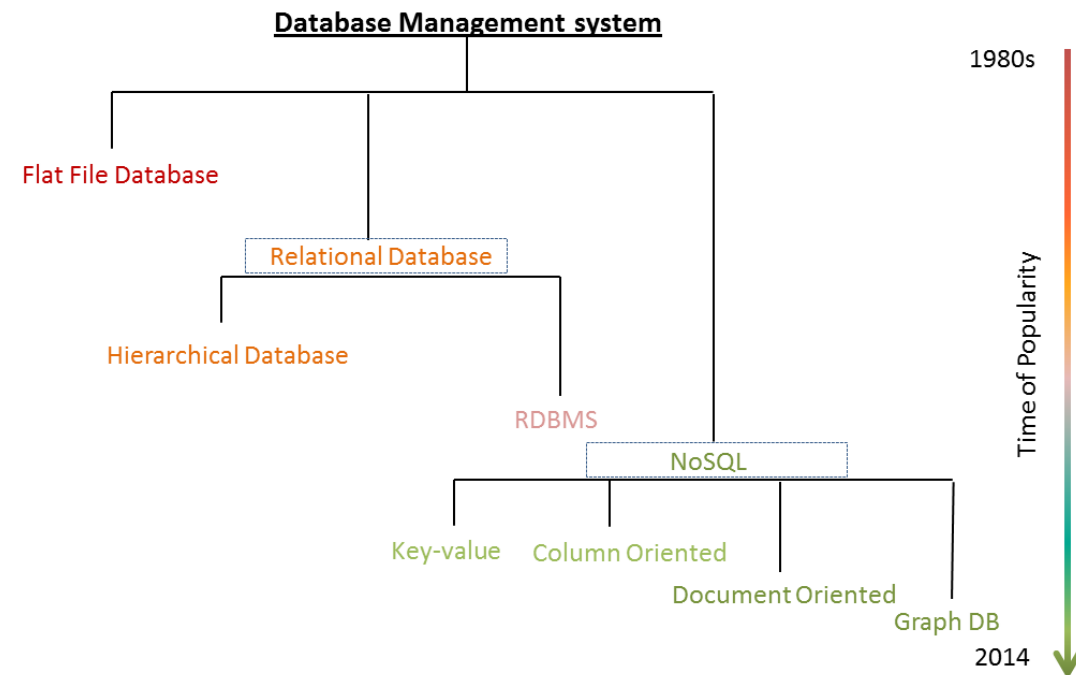
❑ There are four main types of Database:

- Relational Database
- Flat File Database
- Object-Oriented
- Hierarchical Database

❑ Unstructured database

- NoSQL

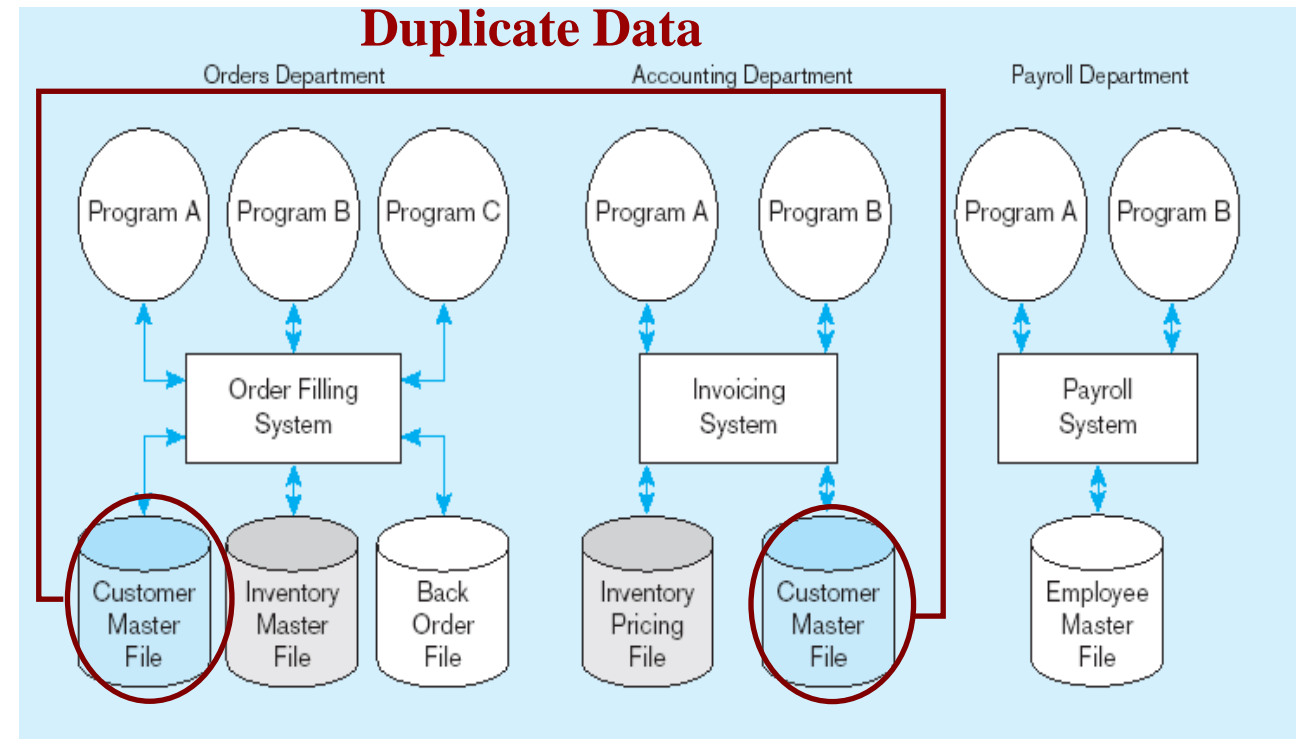
❑



Pre-DBMS Data Management: File System Approach

❑ Problems of Pre-DBMS Data Management

- Redundancy: multiple copies
- Inconsistency: independent updates
- Inaccuracy: concurrent updates
- Incompatibility: multiple formats
- Insecurity: proliferation
- Inauditability: poor chain of responsibility
- Inflexibility: changes are difficult to apply



Solution: The Database Approach

- ❑ Eventually recognized that data is a critical corporate asset (along with capital and personnel)
 - Need to manage the data in a more systematic manner
- ❑ **Database approach:** Use a single/distributed repository to maintain data that is defined once and accessed by various users
 - Addresses the aforementioned problems

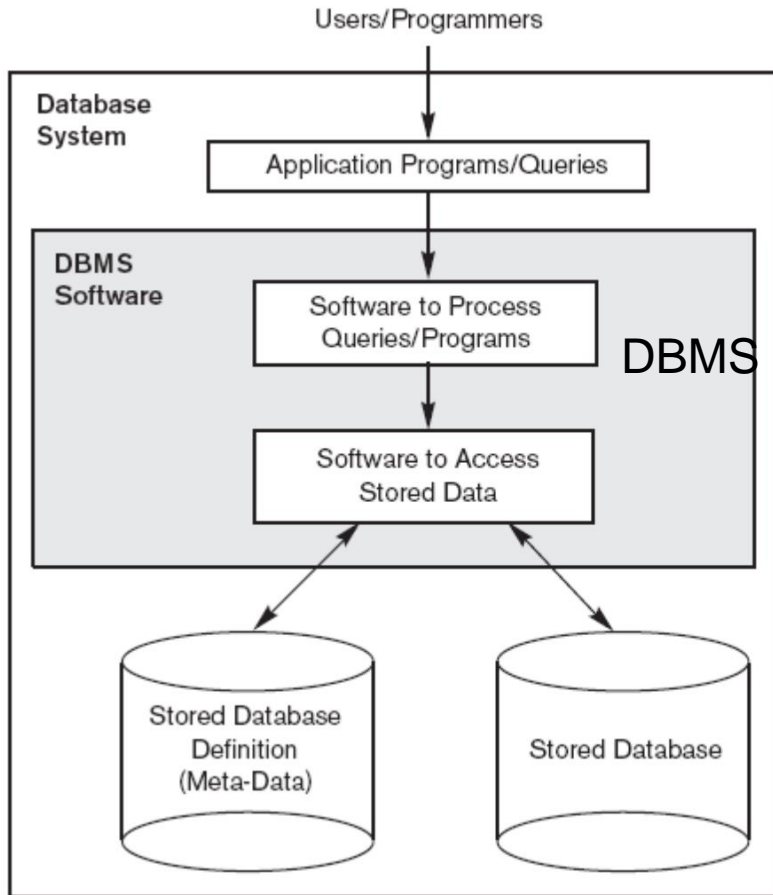
Requires a Database Management System (DBMS)

- Central/distributed repository of shared data
- Data is managed by a controlling agent
- Stored in a standardized, convenient form

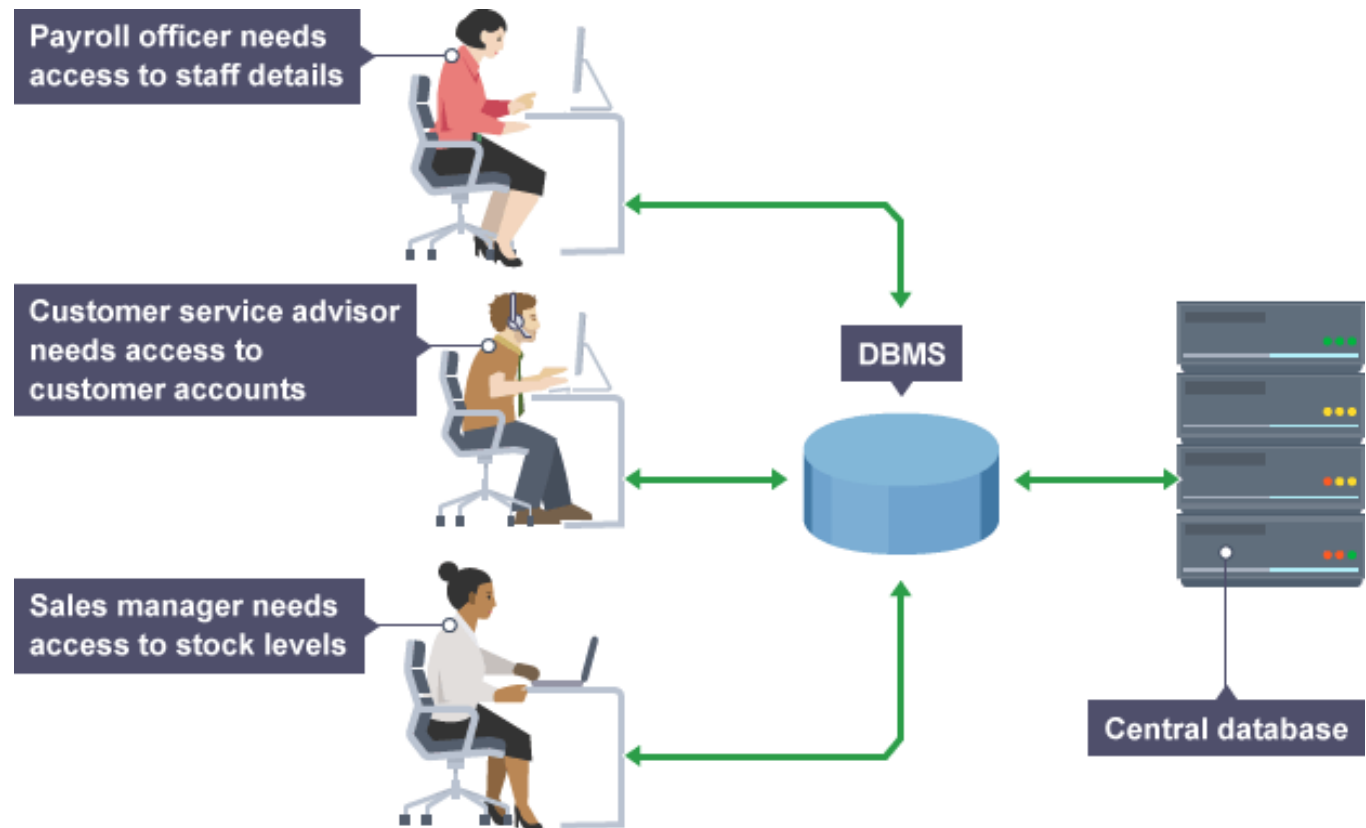
What is a DBMS?

- ❑ A DBMS or **Database Management System** refers to a Software package that services in communicating with the database by supporting in operations like:
 - creating, updating, deleting, fetching, viewing, manipulating & administering the Database system and its contents,
 - usually comes with preset tools, functions, operations that can be used for defining the data, retrieving the data, managing the access permissions for the database, manipulation of the data & the tables in the database, maintenance of the contents of the database, by making use of common query languages such as SQL, T-SQL, etc.
- ❑ Examples of DBMSs
 - Oracle, **Microsoft SQL Server**, IBM DB2, Vertica, Teradata.
 - Open source: **MySQL** (Sun/Oracle), PostgreSQL, CouchDB.
 - Open source library: **SQLite**

Database System



DBMS- Database Management System



Characteristics of the Database Approach

- ❑ Programs isolated from data through abstraction
 - DBMS does not expose details of how (or where) data is stored or how operations are implemented
 - Programs refer to an abstract model of the data, rather than data storage details
 - Data structures and storage organization can be changed without having to change the application programs
- ❑ Support of multiple views of the data
- ❑ Different users may see different views of the database, which contain only the data of interest to these users
- ❑ Multi-user transaction processing
 - Encapsulates sequence of operations to behave atomically
 - e.g., transferring funds

Advantages of the Database approach

- + Promote Program-data independency
- + Reduce data redundancy
- + Improve data consistency
- + Improve data sharing
- + Enforcement of standards
- + Improve data quality
- + Improve data accessibility and responsiveness

What is Data Management?

- ❑ Find data (search and query)
- ❑ Update or modify data
- ❑ Ensure data consistency
- ❑ Protect data
 - from unauthorized access (access control)
 - from failures (recovery)
 - from other programs or users (concurrency control)

Finding data?

☐ Query:

- Find the average enrollment in database courses at UBT?

☐ How could we find this using a conventional search within file system?

- Do we get what we want?
- Why is this hard?

☐ How could we find this using a Database Management System (DBMS)?

What Does a DBMS Offer?

- ❑ Efficient data storage.
- ❑ Abstract data model.
- ❑ Query & data manipulation language.
- ❑ Different views of the data.
- ❑ Data integrity & security.
- ❑ Support application development.
- ❑ Concurrent access by multiple users.
- ❑ Crash recovery.
- ❑ Data analysis, mining, visualization, ...

How to Use a DBMS

❑ Requirements modeling (conceptual)

- Decide what entities should be part of the application and how they are related

❑ Schema design and database creation

- Decide on a database schema
- Define the schema to the DBMS
- Load data into the database

❑ Access to data

- Use a database language
- Write database application programs
- Use database application programs

Elements of the Database Approach

Data models

- Graphical system capturing nature and relationship of data
- Enterprise Data Model–high-level entities and relationships for the organization
- Project Data Model–more detailed view, matching data structure in database or data warehouse

Entities

- Noun form describing a person, place, object, event, or concept
- Composed of attributes

Relationships

- Between entities
- Usually one-to-many (1:M) or many-to-many (M:N)

Relational Databases

- Database technology involving tables (relations) representing entities and primary/foreign keys representing relationships

Defining a Database

- ❑ Specifying the data types, structures, and constraints of the data to be stored
- ❑ Uses a Data Definition Language (DDL)
- ❑ **Meta-data:** Database definition or descriptive information
 - Stored by the DBMS in a database catalog or data dictionary
- ❑ Phases for designing a database:
 - Requirements specification and analysis
 - Conceptual design
 - e.g., using the Entity-Relationship model
 - Logical design
 - e.g., using the relational model
 - Physical design

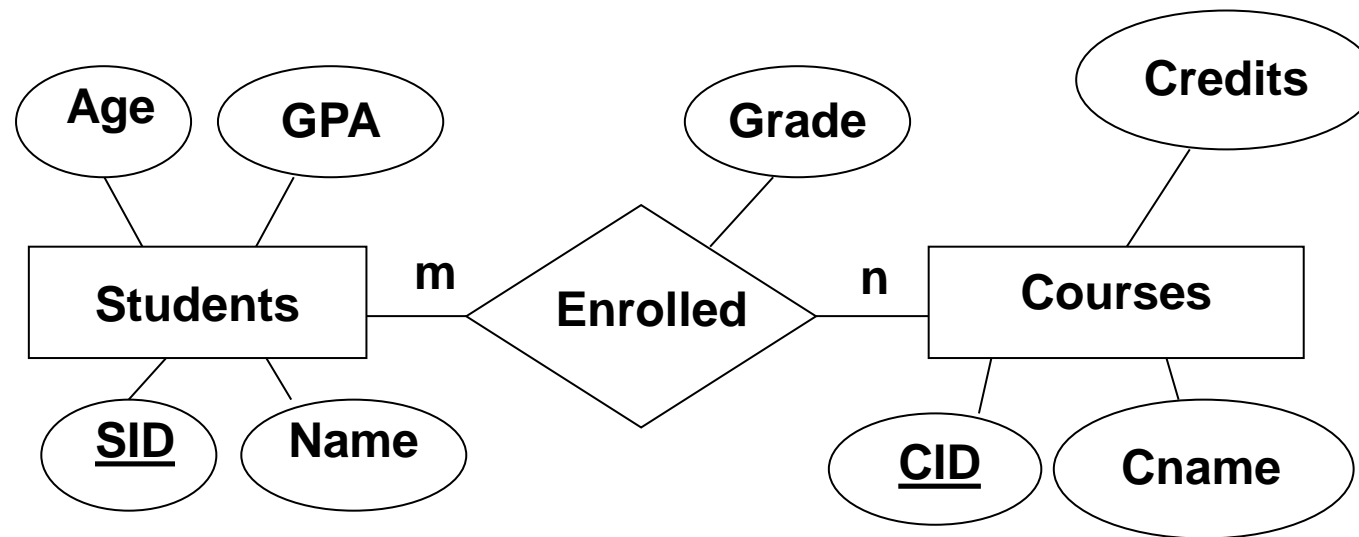
Data Model & DB Schema

- ❑ A data model is a collection of concepts for describing data in a DB, including
 - Objects
 - Relationships among objects
 - Constraints on objects & relationships
 - Operations on objects & relationships
- ❑ A schema is a description of a particular collection of data, using a given data model.
- ❑ An instance is a particular set of data in the DB.

Entity-Relationship Model

□ A popular *conceptual model*.

- Concepts include entities, relationships, constraints.



Relational Model

- The most widely used logical model today.
 - Concepts include: tables, constraints, operations, ...

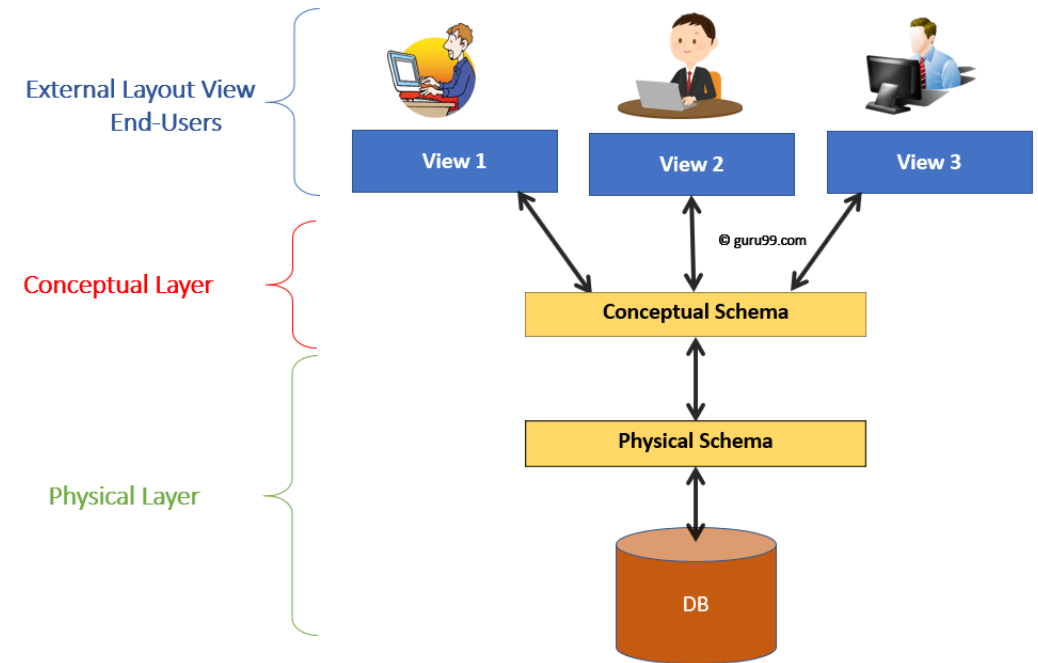
Students(sid: string, name: string, login: string, age: integer, gpa:real)

Courses(cid: string, cname:string, credits:integer)

Enrolled(sid:string, cid:string, grade:string)

Abstract levels of DB Schema

- ❑ **Views** describe how users see the data.
- ❑ **Conceptual schema** defines logical structure using a data model
- ❑ **Physical schema** describes the files and indices used.



Example: University Database

- A View for registrar office

Course_info(cid:string, enrollment:integer)

- The conceptual schema:

Students(sid: string, name: string, login:string, age: integer, gpa:real)

Courses(cid: string, cname:string, credits:integer)

Enrolled(sid:string, cid:string, grade:string)

- the physical schema:

- Relations stored as unordered files.
- Index on first column of Students.

Data Independence

- ❑ DBMS is able to hide details of lower level schema from clients of higher level schema
- ❑ Logical data independence: Protects views from changes in logical (conceptual) structure of data.
- ❑ Physical data independence: Protects conceptual schema from changes in physical structure of data.

➡ One of the most important benefits of using a DBMS!

Database Language

- ❑ Data Definition Language (DDL). Used to define & change database schemas.
- ❑ Data Manipulation Language (DML). Used to query & update data
- ❑ Storage Definition Language (SDL). Specify the physical schema.
- ❑ View Definition Language (VDL). Used to represent information to users.

Who Are Happy w/ Databases?

- ❑ DBMS implementers (???)
- ❑ End users and DBMS vendors
- ❑ DB application programmers
 - E.g. smart webmasters
- ❑ Database administrator (DBA)
 - Designs logical /physical schemas
 - Handles security and authorization
 - Data availability, crash recovery
 - Database tuning as needs evolve

Must understand how a DBMS works!

Summary

- ❑ DBMS used to maintain, query large datasets.
- ❑ Benefits include recovery from system crashes, concurrent access, quick application development, data integrity, and security.
- ❑ Levels of abstraction give data independence.
- ❑ A DBMS typically has a layered architecture.
- ❑ DBAs hold responsible jobs and are well-paid!
- ❑ DBMS R&D is one of the broadest, most exciting areas in CS.

Pyetje

